Zero Retries issue 0071 2022-11-04

Zero Retries is an independent email newsletter about technological innovation in Amateur Radio, for a self-selecting niche audience. It's free (as in beer) to subscribe.

About Zero Retries

Steve Stroh N8GNJ, Editor

Jack Stroh, Late Night Assistant Editor Emeritus

In this issue:

- **Request To Send**
- **US Army Needs New Tactical Radios**
- **Starlink Emergency Neighborhood Area Network**
- **QRP Labs QDX Digital Transceiver**
- **ZR > BEACON**
- **Join the *Fun* on Amateur Radio**
- **Closing The Channel**

Request To Send

One of the ~~failures~~ *pivots* of Zero Retries from how I initially imagined it was that there would be other authors that would contribute to Zero Retries. To date, I've only had a few folks directly offer their writing for Zero Retries, and thus most "non-N8GNJ" writing in Zero Retries are excerpts from other places that either agreed to let me use their posts in whole (such as the great **QRP Labs QDX Digital Transceiver** article in this issue) or I include a minimal fair use excerpt with a link to the original article.

An example of the latter was last week's article Regarding Fusion. I was taken to task by a few folks who strongly disagreed with statements made in that article by author Chris Petersen K9EQ. In particular, some folks equated my statements

> K9EQ makes some observations about YSF that I had not heard before…
> I recommend the reading the entire article…

that I agreed with K9EQ's statements and conclusions about YSF.

Apologies! Such is the learning curve of a solo, amateur author.

I should be more clear that in including, or excerpting other folk's material in Zero Retries…

I don't necessarily agree with or endorse their statements, conclusions, or overall points of view.

I work hard to try to demarcate *my* content from other author's content that appear in Zero Retries. It's not only fair to do so, doing so acts as something of a disclaimer - their words are *their* words - not mine. That's a fine point at times, and undoubtedly there are times I don't do a good enough job on that.

My intent for inclusion / mentions / excerpts of other folk's material in Zero Retries is that such inclusion, etc. is intended as food for thought, such as items that I wasn't previously aware of and find interesting, and by extension, Zero Retries readers might also not know about and find interesting.

The conventional wisdom (and probably the "safe" thing to do) is to provide some kind of disclaimer to that effect in every issue of Zero Retries. To do any good, that probably needs to be run as part of the masthead. I could also add some "weasel wording" near the end of Zero Retries to this text very close to the end of every issue:

> All excerpts from other authors or organizations, including images, are intended to be fair use.

But, to me, doing either of those puts a bit of a damper on the *fun* of writing and sharing Zero Retries. So, for now, I won't add the "weasel wording"… Unless there's another "significant pushback" where some content from another author gets confused as my / Zero Retries endorsement / agreement with that author. As always with Zero Retries, we'll see how it goes.

N8GNJ > DLARC Update

This week another 250 pounds of material (450 pounds to date), mostly magazines (including some gems from as early as the 1920s) left N8GNJ Labs for Internet Archive's Digital Library of Amateur Radio & Communications (DLARC) to be scanned and posted online.

Some of my contributions are now appearing on Internet Archive, eventually to be cataloged into the DLARC section of Internet Archive. After seeing that my contributed material is now in IA's scanning pipeline, it's time to submit some of the more interesting material I have in my archives.

de Steve N8GNJ

US Army Needs New Tactical Radios

Reading this interesting Army Times story - US Army will ditch old radios amid larger modernization juggle - seemed like a Zero Retries Interesting topic.

My synopsis - The next major battle the US Army is tasked with fighting might be against an enemy that is technologically on par with the (current) US Army's communications systems. But, the US Army can't afford to replace every tactical radio, or the timeline for what they really need in next generation tactical radios.

For a new generation of radios, the US Army has to "juggle" a variety of requirements:

- Price (obviously)
- Development time and production time
- Security (encryption, stealth)
- Network capable
- Physical - form factor, ruggedness, battery life, serviceability
- Ubiquity - ideally you want / need every soldier to have communications, spares, replacement units.

Of course, the US Army turned to its usual suppliers:

> The Army this spring selected two companies, L3Harris Technologies and Thales Defense and Security, to furnish voice and data radios as part of its combat net radio modernization program and a broader push to insulate military networks. The arrangement is worth as much as $6.1 billion.

In turning to "the usual suspects" such as L3Harris, Thales, and perhaps even highly capable radio suppliers such as Motorola Solutions, Codan Communications, etc., the US Army will end up with "the usual solutions" - expensive radios that will take a long time to develop and produce, that will meet the requirements of the contract (but only just), and with the "feature" (for the manufacturer) of built-in obsolescence so the manufacturer will have an advantage in the next round of contracts. There's not much that's changing as fast as radio technology.

Permit me a brief diversion from the stated topic. *The following is from memory, apologies if my telling isn't totally factual.*

In the science fiction novel Footfall, Larry Niven and Jerry Pournelle do a neat literary trick in writing a group of science fiction authors such as themselves into the story. The science fiction authors were convened in desperation after all of Earth's militaries proved ineffective in fighting an extraterrestrial enemy that proved to be unimaginably more capable and technologically superior. Thus the science fiction authors were tasked to "imagine an unimaginable solution" that would be powerful enough to defeat the enemy, but could not be imagined / anticipated / detected by the enemy until it was too late. (Humanity wins in the end - it's a good story, recommended!)

It seems to me that perhaps the US Army needs some "outside the usual suspects thinking" like that group of science fiction authors to conceptualize a better, faster, more cost-effective approach for a new generation of tactical radios than what the "usual suspects" are capable of providing.

To me, conceptually, meeting all the requirements just doesn't seem that tough given the amazing advancements we've seen in software-defined radio technology and powerful *and* energy efficient computing capability. I come to that conclusion after more than a year of writing Zero Retries where I watched for, and reported out on Technological Innovation in Amateur Radio.

Just a few data points to support my (probably woefully ignorant) position:

- TAPR is developing the TangerineSDR using a Field Programmable Gate Array (FPGA) so powerful it can digitize 50 MHz of spectrum in realtime.
- The most recent Apple iPhones offer incredible compute power, especially given their all day battery life. From Wikipedia's Apple silicon article: *The Apple A16 Bionic is a 64-bit ARM-based SoC that first appeared in the iPhone 14 Pro, unveiled on September 7, 2022. The A16 has 16 billion transistors.*
- The Analog Devices ADALM-PLUTO is an inexpensive technology demonstrator / student learning tool that showcases the Analog Devices AD9363 Highly Integrated RF Agile Transceiver and Xilinx® Zynq Z-7010 FPGA. Even this inexpensive device operates from 325 MHz to 3.8 GHz.

Thus all (?) the technology is available "off the shelf" to meet all of the the US Army's technology requirements:

- *Security (encryption, stealth)*
  I can't imagine something much more capable than the Apple A16 Bionic. Yeah, Apple probably doesn't want to be a Defense Department contractor with its chipsets, but surely the US Department of Defense could source equivalent ARM-based modules.
- *Networking capable*
  Amateur Radio does networking with radios designed for voice - it's a matter of modems and computing power. Given the low cost of higher capacity / higher frequency chipsets for mobile phones and Wi-Fi, throw those into the radio for when those capabilities are needed. A new capability is 60 GHz which very high capacity, but hyper local.
  Networking, in this era is much more about software than hardware.
- *Physical - form factor, ruggedness, battery life, serviceability*
  US Army has been doing tactical radios for seventy years now. Surely this is a mature capability. The big step change in physical form is batteries based on lithium have much better power to weight, which means either lighter radios for the same capabilities, or higher capabilities (especially transmit power) for the same weight.

The reason I can say

> It seems to me that perhaps the US Army needs some "outside the usual suspects thinking" like that group of science fiction authors to conceptualize a better, faster, more cost-effective approach for a new generation of tactical radios than what the "usual suspects" are capable of providing.

Is that I've known some intelligent and talented individuals with radio and systems design skills who developed an extraordinary capability relating to radio technology and systems because they had not only intelligence, training, and experience… but were able to apply their intelligence and skills *within Amateur Radio's environment* of using off-the-shelf technology, cost constraints, reasonable compatibility, and ease of use.

Such people see radio technology and systems in an entirely different light than those who don't have hands-on experience with Amateur Radio.

Imagine the difference in capability that hands-on experience with Amateur Radio makes. "Mia"1 and Amy2 are *entirely imagined people*, not modeled on anyone I know.

Mia is an intelligent young woman who excels in all her classes, including advanced maths. She goes to university, perhaps MIT where she does well, including a Ph.D. She is recruited to a company like L3Harris and assigned to a project like the one described above. She does a great job on the team to design a new radio system for the US Army. They do a competent job, but the project took years, the individual radios are expensive, and because the most effective way to implement the communications and security requirements was a dedicated chipset, that's what they did. For any new requirements, and new chipset, and radio, will be required. L3Harris congratulates Mia's team for a job well done.

Then imagine the experience of "Amy". Amy has similar intelligence and a similar academic path as Mia. Unlike Mia, Amy had an encounter early in her life with Amateur Radio - perhaps a school class that arranged a contact with an astronaut on the International Space Station. As a result of that experience, Amy became interested in radio technology and became a young Amateur Radio Operator. In University, Amy sought out opportunities to learn more about radio technology and experimented with various leading edge Amateur Radio systems. Perhaps she even submitted a grant proposal to ARDC to fund an interesting academic experiment involving radio. As a result of her academic career plus her Amateur Radio experiences, Amy is recruited by "Think Different Radio Technologies (TDRT)"3 and ends up on their team bidding on their team competing to design a new radio system for the US Army. Like Amy, many of the team on TDRT have experience in Amateur Radio, and they know that to have a chance of winning the contract for the new radio system for the US Army, they really are going to have to "Think Different" in their design. So they start by prototyping their system with things like a Raspberry Pi 4 Compute Module, and the same chipset as the ADALM-PLUTO. They base most of the system on software, using FPGAs for flexibility and future expansion. TDRT's proposed next generation tactical radio *exceeds* all of the US Army's requirements including cost, time to manufacture, and because it's software-based, has 100% backwards compatibility as well as meeting all of the new requirements.

Amateur Radio *matters*.

Starlink Emergency Neighborhood Area Network

In N8GNJ Labs Joins The Space Age (Zero Retries 0068), I described my unboxing and impressions of my new Starlink terminal.

In passing, I said:

> If I had a generator or large battery bank, it would have been standalone. (There's no DC power option, other than some severe hacking, which I wouldn't bother to do.)
>
> …
>
> The implications of this capability for Amateur Radio and emergency / highly reliable communications are profound, and I'll explore that in future issues of Zero Retries.

Space and deadline didn't allow me to elaborate then, but now that the Winter weather has returned to Whatcom County, with high winds and rain, it's a reasonable time to consider the bigger picture of having a Starlink terminal.

For one, it's possible that in an (unlikely, but possible) widespread, extended power outage, Starlink will be one of the few communications options available besides Amateur Radio. If you've been an Amateur Radio Operator long enough, the idea of Emergency Communication (EMCOM) kind-of gets drilled into you. Make a Go-Kit. Keep your portable radio's batteries charged. Have a source of backup power for your station. Etc.

I started thinking those thoughts about my Starlink. For one, it (practically) requires AC power. Obviously it can be hacked to run on DC, but that's problematic and you risk damaging a $600 unit for a minor savings in power efficiency. Thus, if you want to power Starlink in an emergency from batteries, it's prudent to simply use a DC to 120V AC power inverter. You'll probably end up using a generator because the power requirements of Starlink (especially in cold weather) are significant. I've read that Honda and Yamaha make the best, most reliable and trouble-free small generators.

There's also a new class of battery units such as the EcoFlow DELTA Pro (discovered in this great video) that combine power input circuitry (including from line AC power), battery storage, and AC and DC output that is a small scale battery system. These are essentially a pretty large uninterruptible power supply and are getting really capable, and inherently safe enough to operate indoors (unlike generators).

The Neighbor Issue

In an extended power outage, people get a bit frantic once they can't use, or power, their phones to stay in touch with loved ones. Inevitably, if you have a working Starlink in a power outage, word will quickly get around (if for no other reason that they can hear your generator, or they see your Wi-Fi on their phone), and the neighbors will come asking for help. Thus it's prudent to plan ahead.

Providing neighbors with *Guest* Wi-Fi

For a guest Wi-Fi, pick an outdoor Wi-Fi unit with an omnidirectional antenna and install it on the same pole as the Starlink antenna (with a bit of physical isolation from the Starlink antenna).

Ideally, set up that guest Wi-Fi / Ethernet connection to be a true guest Internet connection, isolated from your home network, so guest users can only get to / from the Internet. It's also prudent to plan ahead to manage the bandwidth of the guest Internet connection - there just isn't any point in allowing guest users to do 4k streaming in an emergency.

I think it's prudent to set this up ahead of time, test it occasionally, and then keep it turned off until needed. I wouldn't over-complicate it by putting in rules (such as a Virtual Private Network that you enable and disable) - you probably won't use this often enough to remember that complicated procedure that requires a computer to enable and disable. Instead, just put the router and Wi-Fi unit on a power switch that you power on when needed, and power off when not needed.

Providing neighbors a way to charge their phone (they *will* ask)

For charging, there are a lot of details to arrange in advance so it will work as expected / hoped in an emergency. Here are some that come to mind:

- One way to make a bit of money (not rapacious, just "providing a service and fairly compensated") is to buy inexpensive AA battery to USB chargers and put it in a ziplock bag with, say, 16 AA alkaline batteries. Costco sells 48 AA alkaline batteries for $19. For $20, they will get at least four full charges onto their phone.
- Perhaps it doesn't matter, but it seems more efficient to do DC to DC conversion for supplying USB charging, thus a 12 volt to multiple USB ports charger4 unit is best (more than one, to have spares).
- If you do decide to have charging service available, have *lots* of various charging cables available - Apple Lightning, USB-C, USB Mini and Micro, etc. It's an inexpensive investment to buy these before you need them.

Yeah, I know… if you're reading this, you're probably an Amateur Radio Operator, and the traditional view is that Amateur Radio is supposed to provide communications *via Amateur Radio*. Well, that was then, this is now, and the world is changing. Starlink is a game changer for emergency communications.

QRP Labs QDX Digital Transceiver

By Paul Elliott WB6CXC

The origin of this article was a posting to a local club mailing list. I thought it was a perfect article for Zero Retries and some back and forth correspondence with WB6CXC resulted in this expanded article (with permission from WB6CXC).

Image courtesy of QRP Labs

There's a very interesting HF transceiver (80 / 60 / 40 / 30 / 20 meters) from QRP Labs: the QDX Digital Transceiver (https://www.qrp-labs.com/qdx.html). This small box has just four ports: USB, Power (12V or 9V), a BNC antenna connector, and a push-to-talk jack (used in testing). There is a small LED on the front panel, but this radio is designed to be used with applications like WSJTX (WSPR, FT8, etc), JS8-Call, Direwolf, and others. Via the USB port the radio presents both a soundcard and serial-port CAT interface to the computer (much like the Icom IC-7300). The transmit power is 5W. People are using Raspberry PIs, other Linux computers, and PCs to control this radio.

Rather than using a traditional SSB modulator for the FSK output, the QDX measures the input signal frequency and uses the Si5351 clock generator chip (one of my favorites) to create the FSK output. No analog modulation, no linear amplifier, no carrier or sideband suppression needed. This is a clever and inexpensive solution

that generates a high-quality signal.

It then adds that to the CAT-controlled "carrier" frequency and programs the internal synthesizer for the correct upper sideband transmit frequency. The receiver design uses a quadrature "Tayloe" mixer and a dual-channel audio analog / digital converter, and then demodulates the digitized "I" and "Q" audio using DSP and sends that out over the USB soundcard interface.

One of the things I like about the QDX is the way it provides a very reasonable functional separation in a digital FSK system. By taking the USB audio input and generating the USB audio output, the QDX is able to be used by all sorts of current and future digital FSK programs. The USB audio / CAT interface is becoming the standard radio / computer connection and the QDX takes full advantage of this.

This functional separation decouples the radio from the protocol, allowing each to evolve at their own pace. The QDX provides a low-cost, high-performance radio, optimized for FSK.

There are quite a few other clever design choices in the QDX. Hans (the designer) has a detailed presentation about the radio: https://www.qrp-labs.com/images/qdx/fdim2022.pdf. The documents and video presentations Hans has created show a lot to admire. I am impressed.

There are some interesting threads about this transceiver on the QRP Labs groups.io [mailing list]. One of particular interest to me is this one: https://groups.io/g/QRPLabs/message/93604 (started by my friend Glenn Elmore N6GN). It discusses the frequency accuracy and stability needed for the FSTW4 mode on HF, as used to monitor skip-related Doppler shifts. As for the "frequency spread" (turns out its "frequency error") mentioned in the thread, Hans suspects it's due to math accuracy or resolution issues and is looking into it. The QDX as-is is still completely functional for most digital modes.

The partially-assembled circuit board costs $69 - you need to wind some toroids and solder some leaded components. A fully-assembled board costs an extra $45. The aluminum enclosure is an extra $20. I just ordered the partially-assembled board and the enclosure, and I'm looking forward to putting this radio through its paces!

ZR > BEACON

In the Closing the Channel section immediately below, I offer my ongoing ***Thanks*** to various folks who regularly contribute in small and large ways to Zero Retries. Until this week, one of those mentions was:

… Southgate Amateur Radio News consistently surface[s] "Zero Retries Interesting" stories.

I was sad to learn via Amateur Radio Newsline that Richard Brunton G4TUT who wrote and published Southgate Amateur Radio News is now a silent keyboard.

> If you follow amateur radio current events you are probably aware of the Southgate Amateur Radio News website. We here at Newsline are sad to report that the colleague of ours in England, who ran that important website, has become a Silent Key. Jeremy Boot G4NJH has that report.
>
> JEREMY: We are sad to announce the passing of Richard Brunton, G4TUT. Richard died at age 77 as the result of a fall on the 21st of October. The callsign may not seem familiar to you, but for decades Richard was editor of the Southgate Amateur Radio News website which has a significant international following. Each and every day, Richard would search the world's ham radio and technology resources seeking out stories of interest and publishing them. Beyond the straight news items and specialist sections of his site, Richard encouraged non-commercial podcasts and blogs to promote ham radio opinion and stimulate debate on the essential subjects of the day. He also compiled the 'CQ Serenade' weekly programme which was broadcast throughout Europe on Shortwaveradio.de and other public-facing media. Richard himself was an intensely private man who had no close family, but he reached thousands of friends daily through his website. Amateur radio has lost a statesman and a stalwart whose dedication to amateur radio was valued and enjoyed by so many.
>
> This is Jeremy Boot G4NJH.

I was in awe of G4TUT's stamina and breadth of content. His output was amazing and consistent and there were always some gems to be found in his mentions. I will miss his contribution to Amateur Radio, and Zero Retries is a bit poorer from his loss.

Join the *Fun* on Amateur Radio

If you're not yet licensed as an Amateur Radio Operator, and would like to join the fun by *literally having a license to experiment with radio technology*, check out
Join the Fun on Amateur Radio for some pointers.

Closing the Channel

In its mission to highlight technological innovation in Amateur Radio, promote Amateur Radio to techies as a literal license to experiment with wireless technology, and make Amateur Radio more relevant to society in the 2020s and beyond, Zero Retries is published via email and web, and is available to anyone at no cost. Zero Retries is proud *not to participate* in the Amateur Radio Publishing Industrial Complex, which hides Amateur Radio content behind paywalls.

My ongoing ***Thanks*** to:

- Tina Stroh KD7WSF for, well, *everything!*
- Pseudostaffers Dan Romanchik KB6NU and Jeff Davis KE9V for continuing to spot, and write about "Zero Retries Interesting" items on his blog that I don't spot on my own.
- Amateur Radio Weekly and Southgate Amateur Radio News consistently surface "Zero Retries Interesting" stories.

- The Substack email publishing platform makes Zero Retries possible. I recommend it for publishing newsletters.

If you're reading this issue on the web and you'd like to see Zero Retries in your email Inbox every Friday afternoon, just click:

Subscribe now

If you're a fellow smart person that uses **RSS**, there *is* an **RSS feed for Zero Retries**.

Zero Retries is on Twitter @ZeroRetries - just click:

Zero Retries on Twitter

Please tell your friends and co-conspirators about Zero Retries - just click:

Share Zero Retries

Offering **feedback or comments** for Zero Retries is equally easy; yes, you guessed it… just click:

Leave a comment

Email issues of Zero Retries are "instrumented" by Substack to gather basic statistics about opens, clicking links, etc. I don't use such information in any way other than seeing that most subscribers actually do read Zero Retries.

More bits from Steve Stroh N8GNJ:

- SuperPacket blog - *Discussing new generations of Amateur Radio Data Communications - beyond Packet Radio (a precursor to Zero Retries)*
- N8GNJ blog - *Amateur Radio Station N8GNJ and the mad science experiments at N8GNJ Labs - Bellingham, Washington, USA*

Thanks for reading!
Steve Stroh N8GNJ / WRPS598 (He / Him / His)
These bits were handcrafted in beautiful Bellingham, Washington, USA
2022-11-04

If you'd like to reuse an article in this issue, for example for club or other newsletters, just ask. Please provide credit for the content to me and any other authors.

All excerpts from other authors or organizations, including images, are intended to be fair use.

Portions Copyright © 2021-2022 by Steven K. Stroh.

Blanket permission granted for TAPR to use any Steve Stroh content for the TAPR Packet Status Register (PSR) newsletter (I *owe* them from *way* back).

1

Name chosen randomly.

2

Name chosen randomly.

3

Fictitious company name (as far as I'm aware)

4

Not recommending *this* unit, provided only for example.